ENGINEERING NEWS

Tribune Building, New York City.

GEO. H. FROST, PROPRIETOR.

SATURDAY, JULY ,16 1881.

WE have received several complaints from subscribers, now residing in Mexico, in regard to the irregularity and in some cases of the non-arrival of their papers. We have written to these parties—using the same addresses as those upon the wrappers of the papers—and in every instance the letter has been received. Last Thursday morning we made inquiries at the office of the Superintendent of Foreign Mails, this city, and learned that the complaints were general, and that the department had traced papers to the border, after which they entered the Mexican service and never reached their destination. We can offer no solution of the problem, as all papers for foreign countries are addressed and properly stamped in this office. As Mexico is the only country from which we receive such inquiries, we can safely place the blame at the door of the Postal Service of that country.

LOCAL ENGINEERS' SOCIETIES.

With the growth of the various engineering professions and the tendency of their members to gather in numbers in the great centers of population, a desire for local engineering societies is becoming more general. Abroad, and not only in England and Germany, local organizations are growing in importance, though not so much individually as collectively. Their mission is a very much greater one than is generally supposed, and their sphere of usefulness, though apparently narrow is indirectly at least by far wider than the occasional reports which reach the profession at large are likely to indicate. As a rule in such organizations, the younger members are the most active in doing actual work, the older engineers limiting themselves to giving the society the weight of their names, acting as honorary or executive officers, and tendering advice. The younger members are naturally content in the beginning to make a local reputation, and as a training school in the clear presentation of professional topics and their discussion such clubs are of incalculable importance. In this country a beginning is being made in this direction, but there is much room for further and more general foundation of local engineering societies, whose value in promoting the interests of younger men by affording them frequent social and professional intercourse with one another, and with older and more experienced engineers, is invaluable. To have small engineers' societies in every one of our larger cities, possessing a library, and having on file the principal journals of their own and allied professions would contribute much to the welfare and progress of the individual and the profession. Books follow progress only at a distance, and the meetings of our national societies are unfortunately rarely attended by young engineers, who have neither the means nor the leisure to travel great distances. The machinery of these societies is too ponderous, the discussions are carried on by the magnates of the profession, and occasionally, too, by a number of men who appear to possess an uncontrollable desire to hear their voices on any topic that is brought up. In such societies the body of the members do not, and often cannot, take an active part. It is true that occasionally some particularly self-confident young man will read an essay on some special subject on which he has "posted" himself, but which is really little more than a more or less clever summary of the experience which others have placed on record before him. The resignation of his audience and the ominous silence at the close of his paper will generally convince him of his mistake.

The technical press is a valued friend of the young engineer, and in its position in the van of progress it has a wide and important field. By its vigilance it must keep him informed of all that is going on. No one who has followed the policy of a well-conducted technical newspaper will deny its success in treating intelligently and almost authoritatively of special professional subjects, and as a record of current practical experience its services are and deserve to be highly appreciated. But while say one-half of the matter it offers is such that it insures its being embodied in every engineer's library for future reference, the other portion is devoted to subjects which derive their main value as affecting the interests of every one, or a large class in the profession, for the time being. As news such matter is temporarily important. While the technical press therefore fills a large field of its own, and through its columns often conducts valuable discussion, it cannot give to it the charm and the profit of a personal debate, nor afford the advantages of frequent personal intercourse. That we believe must be accomplished by the formation of local engineering societies, which in other ways, too, are capable of doing much good. As a rule, their membership cannot be limited to one branch; they must recruit from civil engineers as well as from mechanical and mining engineers. The reading of papers and the discussion of topics pertaining to either of these branches is valuable to those who are not directly interested. It will aid in guarding against a danger into which specialists easily drift, and afford them the means of obtaining a more general view of matters pertaining to their own and allied professions. Good work has begun in this direction by the formation of societies in Philadelphia, Pittsburgh, Chicago, Boston, and other cities, and the prosperity and rapid growth of some of these "home clubs," as we might call them, encourages the belief that there is room for many more of them. We hope and expect to see them increase in number in the near future.

PERSONAL.

Only five of the Mexican Central R. R. surveyors were killed. The names and particulars have not yet reached us.

A party of surveyors under Mr. Bailey, C.E., are making a trial survey of a route for the Ontario & Sault Ste. Marie Railway, running from Coldwater, on the Nipissing line, westward.

Mr. Marcus Smith, Deputy Chief Engineer of the Canada Pacific Railway, was at Burrard Inlet on the 22d ult., and examined Coal Harbor and English Bay.

The first payment of $200,000 upon the 4,000,000 acres of land purchased in Florida by the Philadelphia Company was made on Tuesday the 5th, by Mr. Hamilton Disston.

Mr. Collingwood Schreiber, Chief Engineer of the Canada Pacific Railway, has left for British Columbia to inspect the Pacific section of the Canada Pacific Railway.

Col. Williams, M.P., of Port Hope, has received a telegram from Mr. Hannaford, Chief Engineer of the G. T. R., intimating that the laying of a double track on the line in that section will be immediately proceeded with.

Mr. J. F. Alden, long connected with the Leighton Bridge and Iron Works of Rochester, New York, and for the past six years chief engineer of the same, has formed a partnership with the Lassig Bridge Works of Chicago, Ill.

Mr. B. W. Gossage has resigned his position as Chief Engineer of the Canada Southern Railway. The resignation took effect on July 1. The business of the department will hereafter be conducted by Mr. A. R. Trow, Assistant Engineer.

The newly elected Board of Directors of the Metropolitan Elevated Railway Company was organized this week by the election of Russell Sage as President and Sylvester H. Kneeland as Vice-President.

The principal contractor for the construction of the Chicago, Delphi & Indianapolis Air-Line Railroad has established headquarters at Frankfort, Ind., and is subletting his contract upon the condition that the entire work shall be finished during the present year.

Daniel W. Bemis and Robert W. Waterhouse, civil engineers, of Fitchburg, Mass., the only two New Englanders represented as massacred by the Indians on the Mexican Central Railway, are alive and well according to advices received from San Jose, Mexico.

BOSTON, July 14.—Mr. Montgomery James is one of the engineers of C. C. Upham's party on the Mexican Central Railroad, and was among those who escaped the recent massacre by the Apache Indians. In a letter to his mother, just received, dated Paso del Norte, July 7, he says: "Five of our men were killed near a small hill called San Phillipi. The stage was also stopped by the Apaches, and one man killed and one taken prisoner, who is probably burned to death long before this time. The stage was burned, and we arrived on the scene while it was still on fire. We saved part of the mail, in doing which I burned my hand and damaged the soles of my boots. The Indians destroyed everything. There was a large amount of paper money, which they tore up and burned."

The minister of agriculture has issued instructions to Col. W. Milnor Roberts to make an examination of the Rio das Velhas, province of Minas Geraes, between Macaubas to the Rio Sao Francisco. The surveys are divided into three sections: 1st, a reconnoissance of the river from Macaubas to Trahiras to verify its navigability; 2d, a minute survey of the section between Trahiras and the Paraura bar; 3rd, a continuation of the survey to Guaycuhy, at the mouth of the river, with such a degree of minuteness as the natural difficulties of the river channel may require. A detailed estimate of the cost of all works necessary to the improvement of the river is required, and also a report upon the agricultural and grazing industries of the valley, a topographical sketch of it, and a list of tributaries of the river with their position and importance. The reason for this work, as given by the minister, grows out of the prolongation of the Dom Pedro II. railway from Itabira do Campo to Macaubas, for which the government has ordered the preliminary surveys, to be concluded in a few months. From these river surveys of Colonel Roberts the government expects to determine whether the Dom Pedro II. line shall be connected with the Rio Sao Francisco by navigation, or by a marginal railway. The surveys will probably be made immediately, the survey of the southern ports being postponed for the time.—*Rio. News.*

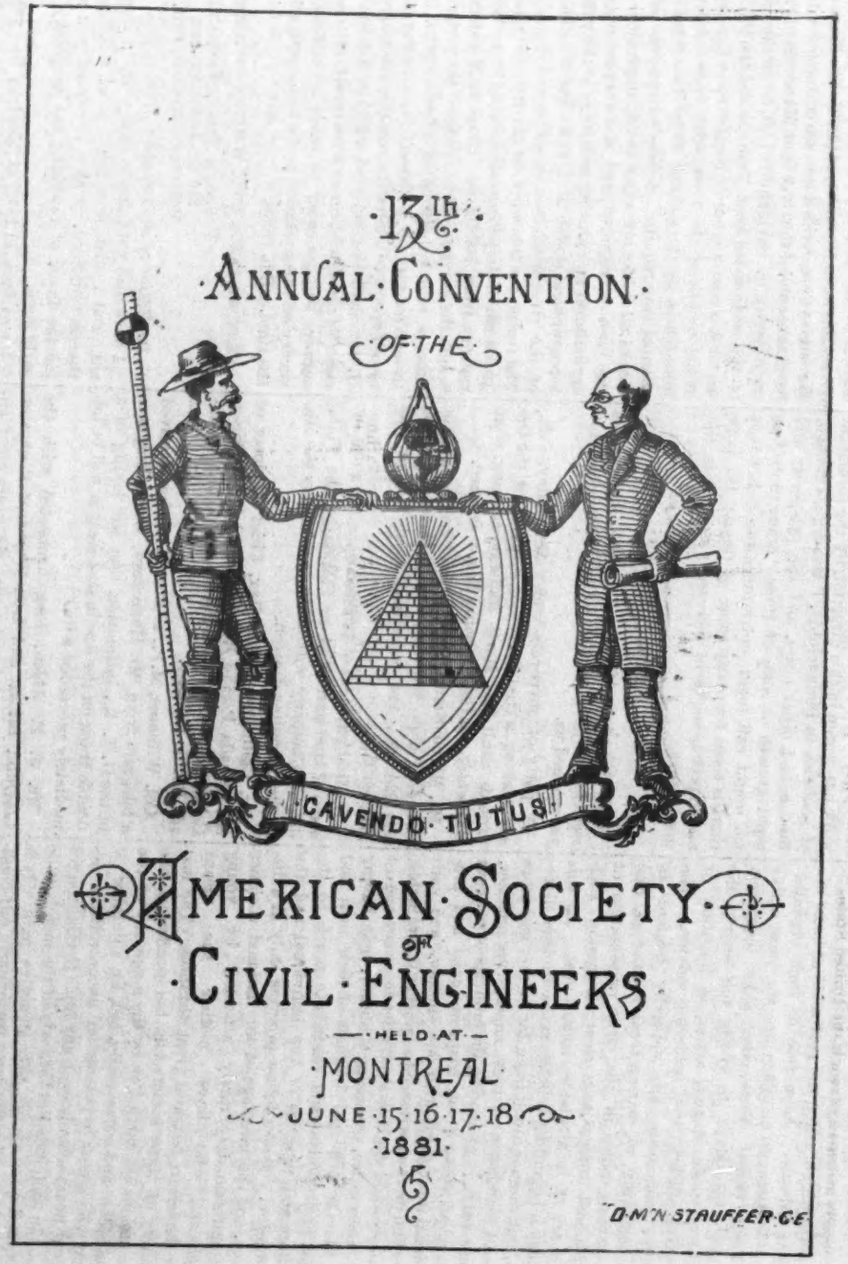
VENNOR'S EARLY LIFE, WRITTEN BY HIMSELF.

VENNOR'S MINING EXCHANGE,
210 ST. JAMES STREET,
MONTREAL, June 28, 1881.

To the Editor of the Republic, Washington, D. C.:

I have read your sketch of my life in your journal, and I wish to correct some misstatements therein contained. I have to request you will do me the favor of rewriting the biography in an early issue.

I was born in 1841, at Montreal (not 1840), and my parents are English. My early life was spent, not in poverty, but in ease and luxury, my father


13th
ANNUAL CONVENTION
OF THE
CAVENDO TUTUS
AMERICAN SOCIETY
OF
CIVIL ENGINEERS
HELD AT
MONTREAL
JUNE 15 16 17 18
1881
D.M.N. STAUFFER C.E.

NIAGARA
CATARACT
CATARACT
PARK
50cts
BOAT ISLAND
ADMISSION
50CTS
BURNING SPRINGS
50cts
CAVE OF THE WINDS
50cts
WHIRL POOL
50cts
HACK
$10.00
IRIS
50cts
HACK
$5.00
FERRY
15cts
RAIL
$100.000
Ye Niagara Millionare.
Ye Victem
Ye Aborigine
Ye other Victem

being a head partner in the leading wholesale hardware establishment of "Budden & Vennor," with houses both at Montreal and Liverpool. My mother was a Patterson and was connected with some of the oldest families in Scotland. My education was not "obtained wholly through his own exertions," but with my brothers at two of the leading schools in Montreal, and after these at the University of McGill, where I was immediately under the tuition of Principal Dawson, Dr. T. Sterry Hunt and other leading professors.

Before leaving the University I took two years of civil engineering and two honor courses in science. I also attended the chemistry classes of our Medical College. After spending about five years in the wholesale hardware firm of Messrs. Frothingham & Workman, of Montreal (during the whole of which time I was a great collector and student of birds and animals), I received an appointment, through the late Sir William E. Logan, Government Geologist, on the Geological Survey of Canada, and spent my first season (1865) in a survey of the Grand Manitoulin Island, Lake Huron. Here I made a very large collection of birds. In 1866 I continued my geological investigations in Hastings County, Province of Ontario, and thence, year after year, explored eastward until Ottawa was reached. From this center, and between the years 1875 and 1880, I examined the whole of Ottawa County and traversed the rivers Gatineau, Lievre and Rouge to their sources in the "unknown wilderness" to the northward. In 1881 I concluded my geological researches in connection with the Government and have opened a general mining agency in this city.

I have only further to state that my "Birds of Prey" cost me some $2,600, and as the work was too expensive for Canada, a great deal of money was lost on it. I have given away a very large number of copies through the United States.

My almanac I hope to make a medium for the exchange of meteorological information throughout Canada and North America. Gain is not my object, and hitherto publishers and agents have made all the profits. I attribute my present position or reputation entirely to my close study of the course of storms in years gone by, and a comparison of these with those of to-day, in every section of country. I have carried the people along with me, not so much by one general strikingly accurate forecast (such as that of the winter of 1881 as a whole), but by numerous well-directed local predictions, unostentatiously published, but telling in their effect upon the people included. Thus, during last winter I at one date dropped a card to Washington, at another to New York and Boston, again to Chicago, Cleveland, Pittsburgh and Cincinnati and St. Louis.

Yours truly, HENRY G. VENNOR.

NEW YORK AND BROOKLYN BRIDGE.

(*Continued from page* 273.)

"At each successive raising, wrought-iron brackets were inserted in the masonry as supports for the feet of the derrick struts. By having the iron work prepared in advance, about one week was required for raising the three derricks on a pier, and about ten days for the six derricks on either anchorage. About 80 ft. in height of the Brooklyn tower (above tide) and 120 ft. of the New York tower were thus laid.

"As a hoist of 40 ft. required 160 ft. of rope to be coiled on the drum of the engine, it was found to be inconvenient to take more than this height for a single hoist; hence when this height was reached a tall derrick was erected at ground level, which raised all materials to a platform placed along the face of the tower. A railroad track on this served for transporting the stone within reach of either of the setting derricks.

"In New York, at 80 ft. height, a second track was built, and the hoist taken to this, from the ground by a gaff attached to the face of the tower. To accommodate the increased length of rope, a smaller drum was made for the engine, so as to avoid the increased leverage caused by the extra turns.

"The derricks used in unloading from the stone scows, and all those used at the stone-yard had the fall from the engine pass up through a hole in the center of the footstep and spindle, and out along the inclined boom to a block at its upper end.

"The disadvantage of these derricks for stone setting is that they only act on the circumference of a circle, and require the boom to be raised or lowered to reach other points. Most of these were arranged with two fixed inclined struts from the head of mast for supports.

"There were several failures of the derricks with inclined struts—all resulting from the upward thrust from the strut when a stone was suspended with boom toward the strut—first, from the breaking of the iron strap clasping the strut at its head, and in the end of which the derrick pin turns; and second, from the pin in head of mast being pulled out, not being securely fastened. Another cause of failure was, the splitting of the footstep; caused by the sides of the hole not being chamfered enough to allow lateral motion of the mast-head. In one case the pin at the mast-head (2½ in. in diameter) broke square across, after about four years constant service.

"All stones were received, assorted and stored at the stone-yard at Red Hook, where fifteen derricks and three steam-engines were in constant use.

"At each anchorage six derricks similar to those used at first on the towers were employed. The guying was in one system, requiring seven sky-guys and ten inclined guys, the load assumed being eight tons on each of two derricks hanging in the same direction. This load was very rarely if ever reached.

"From the heights previously named, the towers were completed by the use of balance setting derricks and a traveling crane; the stone being hoisted to them by a 25 horse-power (nominal) engine, link motion, geared to two heavy drums carrying wire rope of 1½ in. diameter. These hoisted the stone to and through an elevated platform supported by a scaffolding resting on the ground and anchored to the masonry at about every 12 ft. of height. The verticals of this scaffolding were compound beams each made up of six planks and a center piece, all short; the planks broke joints regularly, were securely spiked, and through screw bolts placed at intervals. Each rope passed over a large wood-lined sheave, 4 ft. in diameter, which was supported by a heavy oak frame, securely guyed to the masonry, irons being inserted for the purpose.

"The vertical support of each frame was a compound beam of eight planks and a center piece. It was securely strutted and anchored to the masonry and the elevated platform. The platform and frames were raised ordinarily for every 8 ft. rise of masonry. The drums were disconnected for this purpose, and enough rope unrove to allow of the increased height.

"A wire rope backing line joined the hooks of the two hoisting ropes, so that as one was raised the other was hauled down by the line. As only one gang of masons worked on the tower, this was found to be all that was required, as the hoisting could be done faster than the setting.

"The average speed of hoisting was from 1 to 2 ft. per second. A greater speed was not desirable, on account of the difficulty in properly handling the tag line.

"Owing to the great length of the inclined portion of the ropes, there was a tendency in them to take up a vibratory motion, synchronous with the stroke of the engine, and the engineers were always instructed to change the engine speed occasionally, to arrest this action.

"A double engine, with cranks at right angles, would, on several accounts, have been preferable to the one adopted, chiefly for greater smoothness of action in lowering. The jerks accompanying this, particularly when with a heavy lead, brought severe strains on all the attachments; fortunately, the occasions when such loads were lowered were very rare.

"The balance derricks on the towers had arms of equal length, and the balance weights used were sufficient to balance safely a load of six tons. When stones heavier than this were being handled the balance end was chained down to stone already set, until the stone was run in far enough to be balanced by the weight. Struts under the boom were at times used in setting a heavy stone at the end of the boom.

"It was found most convenient to set a portion of the stones at the points midway between the derricks, by using a heavy oak beam suspended between the derricks, the stone being suspended and set from the center of the beam.

"On the Brooklyn tower these derricks were worked by small steam-engines placed on them and traveling around with them. The steam was brought up from the yard below in iron pipes, and carried to the engines in rubber hose.

"The traveling cranes were used only on the central shafts, and when interfered with by the arches they were replaced by balance derricks. The cranes traversed in two directions, so as to reach every point underneath, and they were supported by scaffolding similar to that for the elevated platforms. They are safer than the balance derricks and more expeditious in use.

(TO BE CONTINUED.)

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.*

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 265.)

XXXII.—TROY.

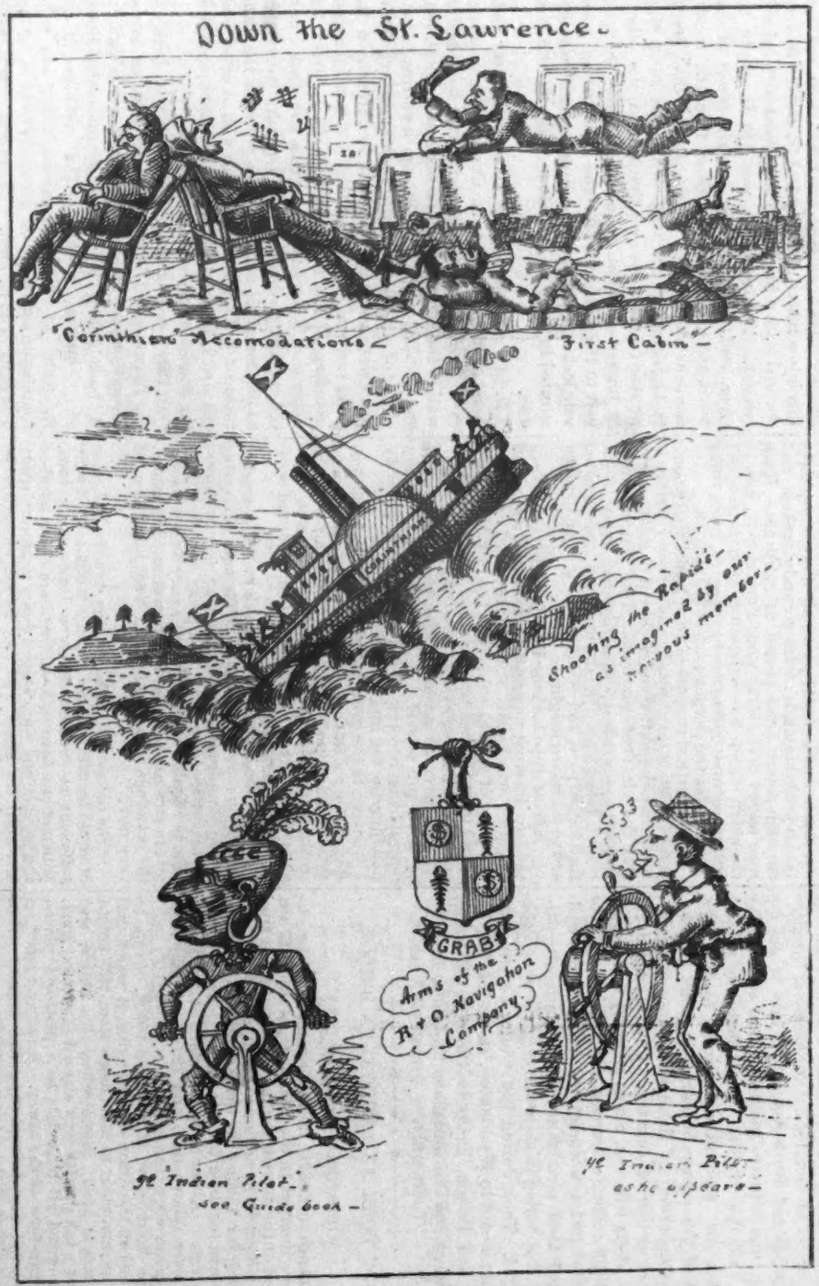
Troy, New York, is on the east bank of the Hudson River at the mouth of the Mohawk, seven miles above Albany. From a plain along the river, the ground rises quite abruptly to a plateau 150 ft. above tide. In the vicinity the ground is high and undulating.

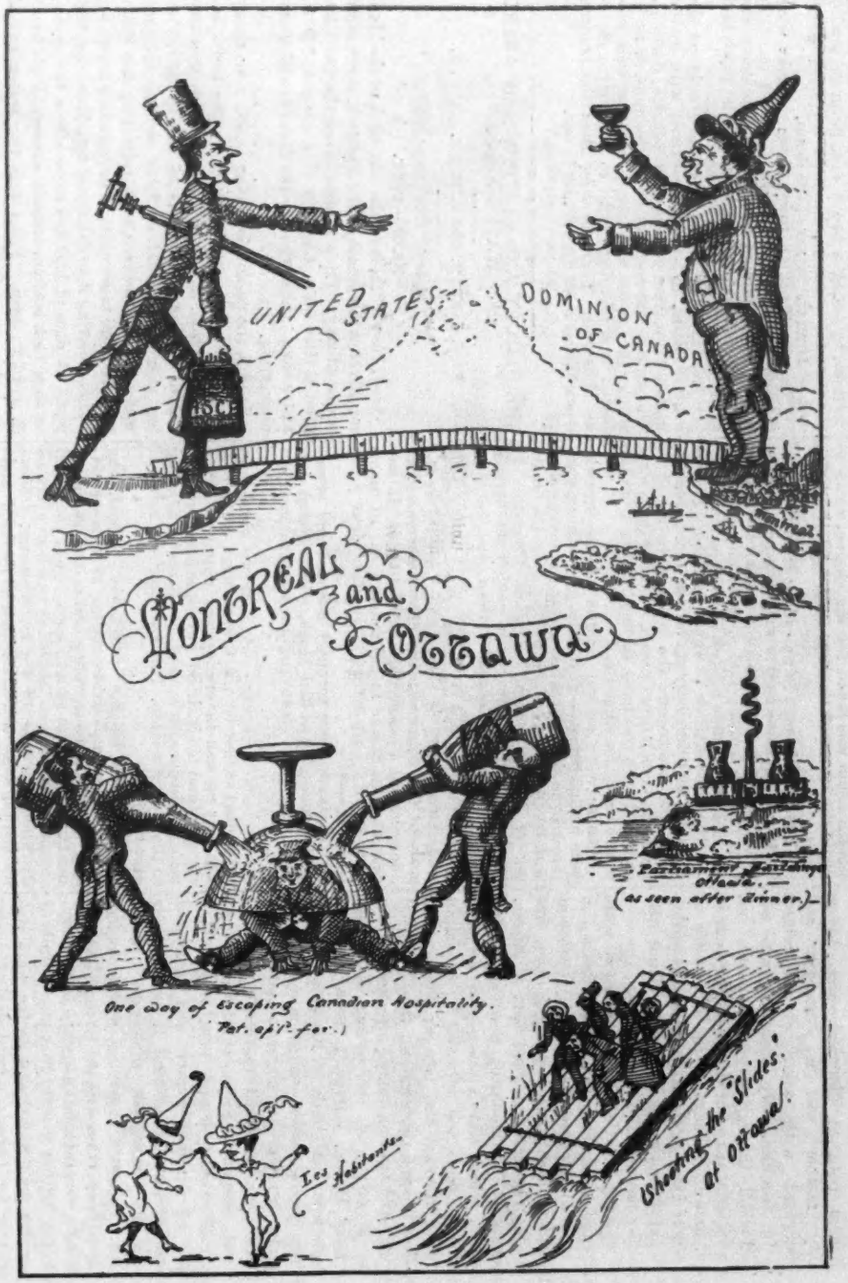
In 1829, the population being 10,000, a company was chartered to supply water to the town, but took no action, and in 1832 its franchise was purchased by the town for $174.34, and in the following year the authorities built works, bringing water from Piscawen Creek, collecting the water from 2 square miles in small impounding reservoirs and conducting it to the tower by a 52-in. cast-iron pipe. A dam of logs and stone across the creek, on slate rock bottom, formed a reservoir 141 by 25 ft. and 5 ft. deep. From this the water passed through a gate 1 ft. below the surface into a reservoir 116 by 67 ft. and 8.3 ft. deep, used as a subsiding reservoir. From this the water passed into another basin 51 by 41 ft. and 8.3 ft. deep, and from this into a reservoir 304 by 18.3 ft. and 8.3 ft. deep, covered with a brick arch and paved with brick in cement. This reservoir was 110 ft. above the river, and 62 ft. above the main street of the town, and about 1,800 ft. distant from it. In 1856 the dam was replaced by one of stone masonry, 17 ft. high and 67.5 ft. long, with two 20-in. pipes leading from it, one near the bottom, the other 3 ft. higher. A 20-in. main was laid from the reservoir to the city. In 1867 the distributing reservoir leaked so badly that a strong puddle was substituted in place of the stone wall on the West side.

In 1859 a reservoir was constructed near Oakwood avenue on Piscawen Creek. The dam is of earth faced with an 18-in. stone wall, has a puddle wall in the centre, is 49 ft. high and 270 ft. long on top. The overflow is through a cutting in rock south of the dam. Two 12-in. and one 20-in. pipes were laid under the bank in a trench in the rock, surrounded with puddle, and having a cast-iron flange 3.5 ft. square on each, 53 ft. from the upper end, convey the water to a stop-cock chamber outside the dam. In 1870 repairs were made to this reservoir and the pipes through the bank replaced by a brick culvert with well at upper end, the well being of brick and the effluent pipes leading therefrom through the culvert.

In 1862 a second storage reservoir was built on the Piscawen. The embankment thrown across the ravine was of clay, sand and earth puddle. A back filling is formed by the embankment of Cemetery avenue. The puddle is 20 ft. wide at the bottom, beginning on solid foundation and narrows gradually to 16 ft. at top. The bank is 43 ft. high. The effluent pipe is laid in a brick culvert extending under Cemetery avenue.

*Copyright 1881.


Down the St. Lawrence.
"Dominion" Accomodations
First Cabin
Shooting the Rapids as imagined by our nervous member.
GRAB
Arms of the R. & O. Navigation Company.
St. Indian Pilot. see Guide book.
St. Lawrence Pilot as he appears.


UNITED STATES
DOMINION OF CANADA
Montreal and Ottawa
Parliament Buildings Ottawa. (as seen after dinner)
One way of escaping Canadian Hospitality. Pat. apl'd for.)
Les Habitants.
Shooting the "Slides" at Ottawa!

At the upper end of the culvert is a well 18 by 20 ft., of brick, coped with stone, having a dividing wall across it. The walls are 4 ft. thick at the bottom and 2½ ft. thick at the top. In the well are 4 gates at different levels; the lowest is stationary, of plank, the others of iron on brass faces, working by rods and screw.

This reservoir contains 250 million gallons, and is 34 acres in area.

The third new storage reservoir is also located on the Piscawen Creek, 4 miles from the city. The construction is similar to the others, being a bank thrown across the ravine. The culvert containing the effluent pipe extends under the dam, and is 125 ft. long, of oval form, 6½ ft. diameter. It is built of brick. The receiving well at the upper end has a gate-house built over it. The gates are 4 in number, the lowest of plank. The average depth of water is 20 ft.; height of dam, 30 ft.; capacity of reservoir, 180 million gallons.

Just below the distributing reservoir is a small reservoir of 1 million gallons capacity, formed by a stone dam, for use in case of emergency from fire.

Before the completion of the Oakwood avenue reservoir the supply of water to the city was deficient, and a pump of 450,000 gallons per day capacity was put up, taking water from the "Hydraulic Canal" and forcing it directly into the mains. This pump was used from time to time until 1866, when it was replaced by a Holly rotary pump of 1 million gallons capacity. This not being sufficient, a steam pump was put up in 1870. In 1878, the water power being insufficient to work the Flanders pump, which had replaced the Holly, a new turbine of 72-in. diameter was put in, which furnished for a time the requisite power. In 1877 a Knowles steam pump of 600,000 gallons capacity was added, pumping into the mains. From time to time, before completion of the present works, steam fire engines have been called upon to pump water from the river directly into the mains, to supply deficiency.

On the completion of the new works this pumping station was abandoned.

NEW WORKS.

In 1879–80 works were built after the plan of David M. Greene, C. E., taking water from the Hudson River at Lansingburg, a quarter of a mile below the Waterford bridge, and pumping it by steam through a 30-in. rising main, 16,000 ft. to the Oakwood avenue reservoir, supplementing the supply from the Piscawen.

The Inlet Pier is of stone masonry, 356 ft. distant from the pump wall and 250 ft. from the original shore line, in 6½ ft. of water at low stage. It is founded on rock, its length being 55 ft., and bottom width 20½ ft. It is carried up 26½ ft. or 5 ft. above highest known freshet level. The brick gate-house on top is protected on its up-stream side by a parapet of stone masonry extending 4 ft. above the top of the pier. The well in the centre is 6 ft. square and has two 3 ft. square influent openings on its westerly side and southwest corner, one midway between the bottom and low water, the other midway between bottom and high water. The flow is regulated by gates or screens, placed in pockets on the northerly and southerly sides of the well, operated by hand wheels in the gate-house. The wall is carried down 15 ft. into solid rock, where it meets the tunnel to the well. In view of the possible destruction of the State dam, a 30-in. pipe is laid out into the old channel of the river.

A tunnel extends from the Inlet Pier to the Rump Well, 356 ft. It is wholly in solid rock, about 7½ ft. high and 4½ ft. wide. It has an ascending grade of 1 ft. in 140 from the pump well to the pier.

The pump well under the engine-house is 8 by 12 ft. inside. It is 45 ft. deep below surface of ground, or 38 ft. below cellar bottom. The walls are of rock-dressed masonry, 2 ft. thick, the coping of which is 14 ft. below low water.

There are two sets of quadruplex engines and pumps of the Holly type. The capacity of each set is 6,000,000 gallons in 24 hours. Each set has 4 cylinders coupled to one shaft. They are set at 45° angle with the horizon, and have their pumps directly under in the same piston line, the rod being coupled between the two with keys. They are double-acting pumps. Any pump can be disconnected at will.

The steam cylinders are 27 in. in diameter, stroke, 36 in. They are steam-jacketed and are low pressure.

The diameter of the pumps is 17¾ in., stroke, 36 in. The fly-wheels, of which there is one for each set, are 13.3 ft. diameter.

The rising main starts from engine-house in 2 branches 24 in. diameter, which unite outside in a 30-in. main, 16,000 ft long, terminating in a masonry wall at the Oakwood reservoir. There are several curves in the main of 20-ft. radius.

A new high-service reservoir was built on Piscawen Creek. It is triangular in shape.

The main dam is of earth 330 ft. long 15 ft. wide on top, with inside slope of 2 to 1, outside of 1½ to 1. The dam is 19 ft. high, carried 4 ft. above high water. There is a puddle wall in the bank 6 ft. wide on top, increasing in width 1 ft. for each 6 ft. in depth and carried off into rock bed. Near the north end is located a waste weir and spill way of masonry, 20 ft. long.

One hundred and twenty ft. above the main dam is a compartment wall of rubble masonry in cement, 110 ft. long with, spill way 57 ft. long, 270 ft. above the main dam, and 60 ft. from the head of the pond is a head wall of masonry 33 ft. long on top, with spill way 27 ft. long.

A well and gate-house is situated at the southerly end of main dam. The maximum depth is 15 ft., but the gates are so arranged that only 6 ft. can be drawn from the surface directly. The storage capacity above this level is 2,500,000 gallons. The distributing main is 20 in. in diameter. The elevation of the flow line is 382 ft. above tide.

Distribution is by cast-iron pipes, 36,000 ft. of which is 4 in. in diameter, and about 9,000 ft. of less diameter. There are 429 miles of pipes and 400 fire hydrants. The consumption is not given. Some meters are used but their number and the number of taps are not given in the reports. The population in 1880 was 56,747. Previous to 1855 the works were managed by a committee of the Common Council. Since that time they have been controlled by a board of five water commissioners, who report to the Common Council.

The entire cost of the works to March, 1881, had been $926,082.16.

The bonded indebtedness is $300,000. The income for 1880 was $74,477.35, and the expenditures for maintenance $39,281, for extension of works $86,521.75 and for interest $28,500.

The receipts for 26 years past have amounted to $970,244.59, and the expenditures for maintenance $382,144.27, for construction $751,092.16 and for interest $107,196.07.

XXXIV.—OTTAWA.

Ottawa, Canada, on the south bank of the Ottawa River, between Chaudiere Falls and the mouth of the Rideau River, comprises 2.74 square miles of undulating surface, of a general elevation of 50 ft. above the river below the Falls. Founded about 1825, and then called Bytown, it became in 1858 the seat of government of the Dominion of Canada. In 1872, the population being about 22,000, the construction of water-works was begun, after the plans of Thomas C. Keefer, C.E., and the supply began in October, 1874.

Water is obtained from the Ottawa River above the Falls. Two lines of crib-work, 60 ft. apart and 200 ft. long, with stop gates at the shore end, form the entrance to a canal 20 ft. wide, cut through rock to a depth of 13 ft. below low water for 2,500 ft. to a short distance beyond the wheel-house. The tail race discharges into the Gully, a ravine passing through the town.

At the upper stop-gate a pier is placed in the canal, in which is a well from which a 30-in. pipe, formed of pine staves 2 in. thick and hooped every 4 ft. with iron, is laid in a trench 3 ft. wide and 1 ft. deep, cut in the rich bottom of the canal, the pipe being anchored down by iron bolts every 12 ft. The anchor bolts are of 1 in. round iron, sharpened at the point, driven into soft pine treenails dropped into the drill holes. Each bolt was tested with a lifting strain of 2½ tons without yielding. The lower end of the clear water pipe leaves the bottom of the canal 70 ft. above the forebays, passes under the retaining walls and goes to the rear of the pumps. This section, 100 ft. long, is of cast iron and has in the wheel-house valves to each set of pumps, and is connected below all the pumps with a 24-in. pipe leading to the canal, through which in case of obstruction to the other pipe, water may be drawn.

Some trouble has occurred with anchor ice or *frasel* at the mouth of the clear water pipe.

The pumping machinery comprises three sets, each of 3 single acting pumps of 19-in. plunger and 42-in. stroke, driven by a Leffel double turbine 61 in. in diameter, so placed as to have a head and fall of 25 ft. at low water. The shaft and couplings are arranged so that each set of pumps may be driven by any one of the wheels. The wheels are geared to the shaft.

Each set of pumps will throw 3.5 million U. S gallons per day, at 17 revolutions per minute of the crank shaft. Each pump is supplied with an air chamber and pumps directly into the mains

The distribution pipes are of cast iron, laid 5 ft. below the surface. There were on Dec., 1880, 42.94 miles of pipe, of which 29 miles were of 5-in. diameter and 4.77 miles of 3-in. Where the trenches are in rock, a line of 5-in. pipe is laid on one side of the street for house and hydrant service, and 3-in. pipe on the other for house service only, both close to the curb line, to save expense in house connections in the rock. In rock trenches the pipe is surrounded with coarse stone, overlaid with finer material and thatched with 18 in. of sawdust.

Some of the pipes were procured from Scotland, but have proved inferior to American pipe.

There are 332 fire plugs and 5,656 taps.

Meters have not been used yet.

The consumption in 1880 was 3,292,000 gallons per day, and the population estimated to be 22,000.

The pumps ordinarily are run with a pressure of 85 lbs., increased in case of fire to 110 lbs. per sqare in.

Robert Surtees, the City Engineer manages the works, reporting to the water committee of the Common Council.

The works cost $914,000. In 1880 the receipts were $92,592.66 and the expenditures for extensions and maintenance $13,901.58.

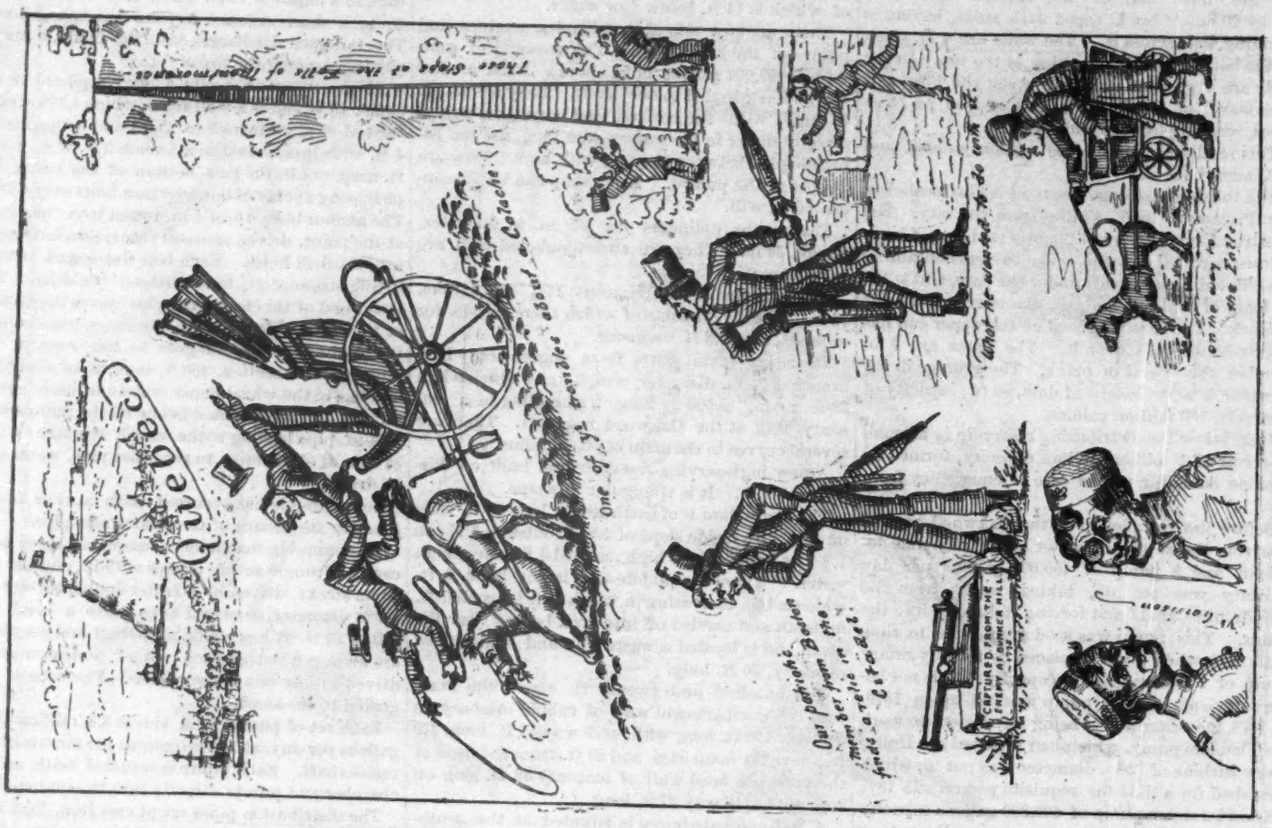
XXXV.—LAWRENCE.

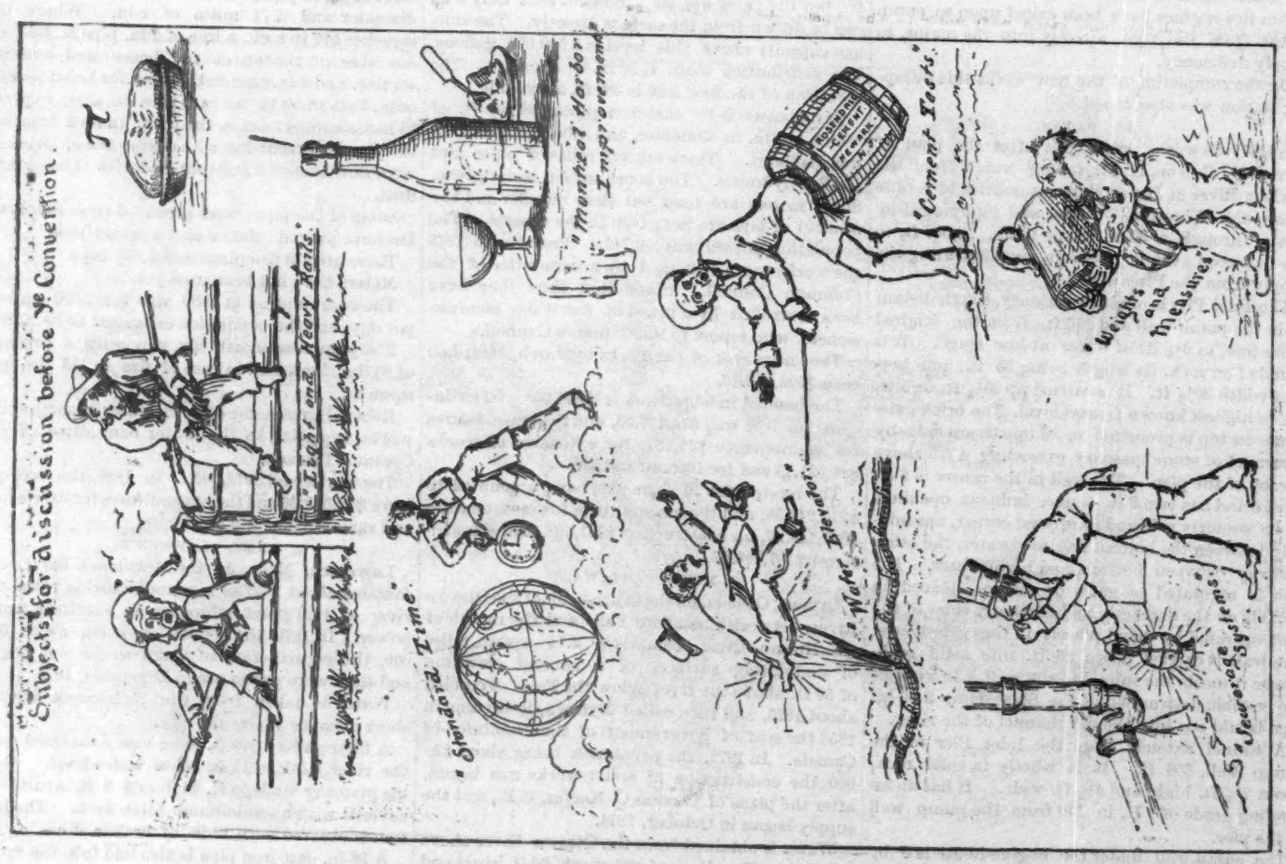
Lawrence, Mass., on the Merrimack River, was founded about 1845 as a manufacturing town, the river at that point affording an excellent water power. In 1873, the population being about 30,000, the construction of water-works was begun and they were put in use in December, 1875.

Water is taken from the Merrimack River a short distance above the city.

A filter gallery 300 ft. long was excavated near the river bank to 15 ft. below water-level. Rubble masonry walls, 4 ft. high and 8 ft. apart, are covered with a semicircular birch arch. The bottom is covered with 12 in. of broken stone.

A 36-in. cast-iron pipe is also laid into the river, terminating in 12 ft. water.


Those Steps of the Transmontane
Queen Cobbe
Our publisher
CAPTURED FROM THE ENEMY AT BUNKER HILL 1775


Subjects for discussion before Ye Convention.
"Montreal Harbor Improvements"
"Light and Heavy Rails"
"Standard Time"
"Cement Tests"
"Weights and Measures"
"Water Elevator"
"Sewerage Systems"

In 1876 a canal was cut between the river and the gallery, which caused the latter to yield a little more water than before, but still not sufficient for the supply. The canal is cleaned every year. The filter gallery and the river inlet discharge into a chamber, whence the water is delivered into the pump well, from which it is pumped by two Leavitt compound beam engines coupled to one flywheel, with high-pressure cylinders of 18-in. and low pressure 38-in. diameter, and "Thames Ditton" pumps with 26⅛-in. barrels and 18⅛-in. plungers, with 96-in. stroke.

The pumps deliver through a 30-in. main 5,000 ft. long (900 ft. of which is laid in a tunnel) into a reservoir built in two compartments, each 375 by 338 ft. at water surface and 25 ft. deep, built in excavation and embankment, with puddled bottom and banks, the bottom paved with cobble stones on gravel, and the slopes lined with dry stone wall on broken stone. The pipes are arranged to pump into either the reservoir or the mains. Two distinct lines of mains lead from the reservoir on different streets, but each is connected with the whole distributing system. The distribution pipe are all cast iron, with Smith's coating. On Jan. 1, 1880, there were in use 40.7 miles of pipe, 2 miles of which are less than 6 in. in diameter, 461 hydrants, 7,001 taps, and 209 meters. The daily consumption in 1879 was 1,456,209 gallons.

The cost of the works to May, 1876, was	$1,159,351.75
Construction account to January, 1880	197,395.83
Maintenance " " "	63,347.54
Interest	371,540.02
Total cost	$1,791,835.14
Revenue 1876 to 1880	240,554.70

For 1879 the expenditures were $28,411.90 and the revenue $62,134.69. The population in 1880 was 39,178. On the first construction of the works rubber-coated service pipes were used, but they are found to become obstructed by rust and rubber scales, and many have been replaced by galvanized iron pipe.

The preliminary surveys and plans were made by L. F. Rice, C. E., and the works were constructed under the superintendence of Walter F. McConnell, C. E., Mr. Kirkwood being consulting engineer. The construction was under three commissioners. The management is in a water board of five members. Henry W. Rogers is the Superintendent.

XXXVI.—MANCHESTER.

Manchester, N. H., is in lat. 42° 59′ N. 71° 3′ 9″ W., on the Merrimack River. The topography is irregular and opposite the city there is a fall of 55 ft. in the river, affording a water power the development of which for manufacturing purposes by the Amoskeag Co. has caused the town to grow rapidly after 1840.

Settled in 1722, and incorporated as the town of Derryfield in 1751, its name was changed in 1810 and in 1846 it was incorporated as a city. In 1872, the population being about 25,000, water-works were constructed after the plans and under the superintendence of John T. Fanning, C. E.

After October, 1871, a temporary supply for fire purposes was obtained from a reservoir and pipes of the Amoskeag Co.

The dam at the outlet of the lake is an earth embankment, with grouted rubble hearting wall in its centre. The overfall is of stone masonry, is 100 ft. long and 24 ft. high above the apron.

Its face is in steps or offsets which break up the falling water.

A canal 15 ft. below the overfall and 1,470 ft. long, with earth sides and bottom, conveys the water to a penstock 600 ft. long, leading to the wheels. The penstock is 6 ft. in diameter, and is made of staves of Georgia pine hooped with iron. It is under 40 ft. head at its lower end, and has stood well for eight years.

Two pair of bucket and plunger pumps, with cylinders 16-in. diameter, plungers 11¼-in. diameter and 40-in. stroke, driven by two 36-in. journal turbines working under 45-ft. head, lift the water 113 ft. through 6,752 ft. of 20-in. pipe, of cement-lined wrought iron, with cast-iron hubs and lead joints, into a reservoir of 2.75 acres area and 19 ft. deep, built in excavation and embankment with the slopes lined with concrete.

This reservoir has stood well. Its surface is 152 ft. above the street at the City Hall, and 188 ft. above the railway station in the city.

New turbines were put in the pump-house in 1875.

The force main is led around the reservoir and connects with the distributing mains, admitting of pumping by direct pressure.

The first distribution pipes were all of wrought iron, cement lined. In 1875 cast-iron pipe began to be used, and since 1876 no cement-lined wrought-iron pipe have been laid, and about 1,000 ft. have been replaced by cast-iron pipe.

On Dec. 31, 1880, there were in use 33.24 miles of pipe, of which 5.48 miles were of cast iron. The distribution is well planned, and only 10,000 ft. are of less than 6 in. diameter.

In 1875 a 12-in. cast-iron pipe was laid across the river to Piscataquay, which has given a great deal of trouble from leaks and breaks.

In March, 1877, a leak was discovered on the east bank of the river, in the spigot end, close to the bell, 5 in. long and ½ in. wide. A temporary sleeve was made, but it leaked, and on taking it off it was found that the sand and water jet had worn out a piece of iron of 8 sq. in., and 1 in. thick, in 48 hours.

The number of leaks in the mains is reported every year.

In the four years, 1877–80, there have been 745 leaks in the cement-lined, and 85 in the cast-iron pipes.

On Jan. 1, 1881, there were in use 307 fire hydrants, 280 meters, and 1,807 taps.

The consumption in 1880 was 1,180,930 gallons per day, and the population 32,630. In the drought in November it became necessary to deepen the canal leading to the pump house.

The total cost of the works, including interest, has been $860,572. 66, and the revenue $358,875.72.

The expenditures for 1880 amounted to $113,870. 54, and the revenue $57,655.25.

The works were built and are managed by five commissioners and the mayor. John T. Fanning was chief engineer and acting as superintendent until March, 1875, when he resigned. Charles K. Walker has been the superintendent since that time.

XXXVII.—BAY CITY.

Bay City, Mich., in lat. 43° 35′ N., long. 83° 50′ W., is on the Saginaw River, about 4 miles from its mouth. The city has a frontage on the river of about 7 miles, and extends back from ½ mile to 2 miles on a plain from 10 to 20 ft. above the river. The soil is a heavy clay, impervious to water, extending to a depth of 100 ft. to rock. Settled in 1835, incorporated as a village in 1859 and as a city in 1865, its population in 1872 was about 10,000, procuring their water supply from cisterns or from shallow wells in which surface water accumulated.

In that year water-works were built, taking water from Saginaw Bay, an arm of Lake Huron, and pumping it directly into the city mains.

The pumping works are within the city limits, the water being brought to them through a 30-in. pipe 21,186 ft. long, laid 7 ft. under water at the bay and having a fall of 4 ft. to the pumps.

The pipe is constructed of pine staves 3 in. thick and from 4 in. to 6 in. wide, dressed and jointed to conform to the circumference of the pipe. It was made in sections 8 ft. long, which were jointed by socket joints 3 in. deep, formed by turning off the end of one pipe one-half the thickness of the staves and boring out the next pipe to correspond. The staves are held in position by elm bands 3 in. wide and ¼ in. thick, passed twice around the pipe 2 ft. apart and fastened with galvanized iron nails. For most of the distance, the pipe is laid in heavy clay soil, where there was no difficulty in securing a suitable foundation. About 2,500 ft. is through quicksand, where the pipe has settled below grade, and sand has been deposited to such an extent as to interfere somewhat with the flow of water. The capacity of the pipe was originally about 5½ million gallons per day, but it is now reduced to a little less than 5 million, and in case of extraordinary demand on the works for fire service a portion of the supply has to be taken from the river through a pipe laid to the pumping station for temporary use before the pipe to the bay was completed.

The water in the bay deepens very gradually, being but 8 ft. deep at 1 mile from shore and 16 ft. at 3 miles out; and in case of a very heavy and long continued southwest gale, which occurs nearly every year, the water is reduced fully 4 ft. below this level, and sometimes remains so for several hours. In order to secure an uninterrupted supply of water, and also protect the end of the pipe from the action of ice, etc., the pipe was laid 1,500 ft. into the bay where it terminated in a basin 300 ft. long, 150 ft. wide and 10 ft. deep, the earth removed in excavating the basin forming a bank all around it. Water was admitted to this basin by an open dredged channel, extending into the bay to 8 ft. of water, the banks of the basin and cut being protected from washing down by sheet-piling driven outside of the banks. The water passes through a timber crib filled with coarse gravel placed at the junction of the cut with the basin.

The water is quite hard, and in the summer frequently becomes quite turbid from the action of the waves, owing to the shoalness of the water and the unprotected condition of the inner slopes of the inlet cut and basin, but will probably not be contaminated by sewage for many years, the source of supply being nearly 4 miles from the mouth of the river, which is the receptacle for all the sewerage of the city and other towns farther up the river.

The pumping engine is a Holly quadruplex engine of 2.5 million gallons capacity under domestic pressure.

A Holly rotary engine of 150 h. p. was also put up, driving two Holly rotary pumps. The pumps are used in emergencies, but are now driven by a high-pressure piston engine with cylinder 18 in. in diameter and 22-in. stroke, geared so as to produce two revolutions of the pumps to three of the engine. The rotary engine has been removed.

For the distribution 19.5 miles of pipe are laid, of which 16 miles are the laminated wood and asphalt pipe called Wyckoff's, a manufactory of which exists in the city. The remaining pipe are of cast iron; 3½ miles of pipe are of less than 6 in. in diameter.

There are 138 fire hydrants and 845 taps.

The cost of construction up to Dec. 31, 1880, was $365,658.58.

The cost of maintenance and operation, not including interest on $377,000 of bonded debt, was $70,365.95 to December, 1880, and the receipts up to that date were $74,073.18. The annual interest on the bonds amounting to $30,160 is paid by the city by general tax. The population in 1880 was 20,653. E. L. Dunbar has been the chief engineer and superintendent of the works from their beginning.

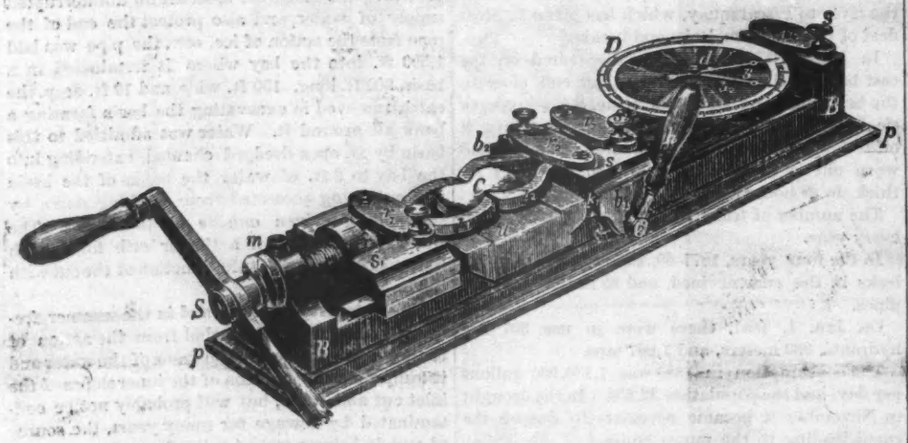
(TO BE CONTINUED.)

The Southern Pacific Railroad is seeking an Atlantic outlet by way of the Chesapeake & Ohio road, by building a connecting line from Marshall, Tex., to Memphis. It will shortly negotiate $100,000,000 of new stock.

NEW DYNAMOMETER FOR TESTING PORTLAND CEMENT.

The apparatus represented in cut is a dynamometer for gauging the resistance of Portland cement, and is the invention of an Austrian engineer. It is constructed to show the resistance under traction, from which the resistance to compression may be easily deducted. To obtain the latter directly would necessitate the construction of too expensive an instrument.

On a prismatic bed B, which is screwed on to a wooden board p, are two slides s, and s_2. The nippers z, and z_2, are attached to the slides by two pegs. The article to be tried is placed between the pincers. The pegs are concealed in the cut under the bolts r_1 and r_2. The slide s_2 is provided with a supplementary peg concealed by the bolt r_3; this latter peg and another concealed under the bolt r_4 serve to fix the position of the dynamometer D. The screw s, which has its nut near m, acts on the slide s_1. The traction force is transmitted by the pincer z_1 to the article to be tried, C; and by the pincer z_2 to the slide s_2, and finally



NEW DYNAMOMETER FOR TESTING PORTLAND CEMENT.

from this last to the dynamometer D. So that all the traction force exerted on the body C should be transmitted by the slide s_2; this slide rests on the slide ways of the prismatic bed, and are planed very even, so that between each of its sides b and b_2—larger at the lower end—and the bed itself, there is an interval which may be filled by the quoits or quoins k_1 and k_2, when these latter are pressed upward by means of an eccentric acted on by the handle h. The needle 3 of the dynamometer moves on the graduated limb according to the tension of the spring. The needle 3_2, which is movable on the axis, is pushed forward by the first by means of a nail near d, so that when the traction force stops, 3_1 retrogrades alone while 3_2 remains in the spot where it reached. To obtain exact indications it is essential that the limb be accurately graduated, and that the traction be made in the axis of the apparatus, the body to be experimented on being itself placed in the line of axis, and finally that all the power exerted on the article be transmitted by the slide s_2 to the dynamometer. The screws s_3 and s_4, and the bolts r_3 and 2_4 have only to be taken out when the dynamometer can be also taken out and weights put on to verify the exactness of the indications, if necessary.

CORRESPONDENCE.

ENGINEERS WANTED.

[As we cannot, at the present time, comply with the following communications, we insert them in this issue, hoping that the vacancies will be satisfactorily filled.—ED. ENG. NEWS.]

CLEVELAND, O., July 11, 1881.

EDITOR ENGINEERING NEWS:

DEAR SIR: Can you send me three or four competent division engineers, capable of taking charge of ten-mile divisions of railroad work, salary $125 per month? Work near Pittsburgh, Pa. Last twelve months. Please advise me without delay.

Yours truly, J. WAINWRIGHT.

Address me 77 Fourth avenue, Pittsburgh, Pa.

HOLYOKE, M.s., July 11, 1881.

EDITOR ENGINEERING NEWS:

Can you send me address of three or four applicants for position of assistant engineers? Want two, or shall want pretty soon. I don't want any smokers or chewers.

Want beginners for office work, mainly; $50 per month. CLEMENS HERSCHEL.

CITY ENGINEER'S OFFICE,
PORT HURON, Mich., July 18, 1881.

EDITOR ENGINEERING NEWS:

In your issue of July 9 Mr. Frank T. Davis claims that I "object to the level notes being worked in the field," which I deny, as I know it is very important to be done. What I object to is the leveler taking and recording his observations and working his level notes at one and the same time. Let him take his observations first, if no more than one or two at a time (the more the better), then stop taking observations until he gets his notes worked out. Then go on with his observations again. My experience has been that a leveler can do that and then have plenty of time for the transit party to get out of the way. I approve of the rodman keeping a record of change points, as all the serious errors are made there. An error in intermediate only affects that one station, but at change points affects the whole chain of levels. J. H. LEAVENWORTH.

PROBLEM IN GEODESY.

PITTSFORD, N. Y., July 8, 1881.

EDITOR ENGINEERING NEWS:

J. M. Houston, in your valuable paper of June 11, proposes the following question:

"(1). What is the best method of running an east and west line where a good degree of accuracy is required, as for instance, a state or county boundary, and the surveyor has no other instrument except a first-class engineer's transit (that in no astronomical instrument)."

A first-class engineer's transit is supposed to be graduated to half minutes.

Let the surveyor therefore deflect from the meridian half a minute less than 90 degrees and run a distance indicated by the following formula:

$$\text{Distance in feet} = \frac{5{,}282^2 \sin. 30''}{\frac{2}{3} \text{ tan. of lat.}}$$

The distance by the formula is 7,511.5 ft.

Therefore, if the surveyor runs a course N. 89° 59′ 30″ E. 7,510.8 ft. in lat. 39°, it will give him a point in the same latitude. He must then deflect one minute to the left from the back sight and run the same distance, which will give him another point in the same latitude, and thus on as far as required. The $\frac{2}{3}$ in the formula is taken as the curvature of the earth in a distance of 5,280 feet.

L. L. NICHOLS.

NOTE.—Let d = deflection proposed at each angle, and x = the distance in feet between the angles, then the following will be the general formula, $x = \frac{5{,}280^2 \times \sin. \frac{1}{2} d.}{\frac{2}{3} \text{ tan. of lat.}}$

COMPOUND CURVES.

WHEELING, W. Va., July 10, 1881.

EDITOR ENGINEERING NEWS:

Will you be kind enough to give space to the following in your valuable paper?

Having run a curve, compounded at any given station, to move the middle of the second branch of the compound curve any given distance toward or from the vertex, and to come out on the same located tangent. There is a formula in "Cleeman's Railroad Engineers' Practice," to move the middle of a simple curve toward or from the vertex any given distance which can also be used for the first branch of a compound curve, regarding it as a simple curve between its two tangents, but I cannot find any formula to do the same with the second branch.

2d. Having run a curve ending in a parallel tangent at a given distance from the required tangent, the formula from Cleeman's "Railroad Engineers' Practice,"

$$R' = R \pm \frac{dist.}{1 - cos.\ I}$$

will give the radius of the new curve started from the same P. C. which will end in the required tangent. I would like to know the simplest method to calculate how much the new curve will be from the first or old curve at each station, and, also, if the position of a curve with a radius calculated by the above formula, starting from the same P. C., will differ any from the first curve, which came out on a parallel tangent rerun to come out on the required tangent by going forward or backward on the tangent by formula

$$A\,B = \frac{dist.\ between\ the\ 2\ tangents}{sin.\ I}.$$

Very truly yours, RESIDENT ENGINEER.

CLEVELAND ENGINEERS' CLUB.

The July meeting of the Engineers' Club was held in the Case block on the evening of the 6th, with Colonel J. M. Wilson in the chair and a large number of members in attendance. The following papers were presented:

Paper—"Remarks on George Stephenson," by A. Mordecai.

"Buildings in the City, Public and Private," by J. M. Richardson.

"Connotton Valley Railroad—Its Progress, Lines and Bridges in the City," by H. F. Dunham.

"Results of the Annual Meeting of the American Society of Civil Engineers at Montreal, in June, 1881," by Charles Latimer.

"Candle Power of Light—How Determined," with experiments, by G. A. Hyde.

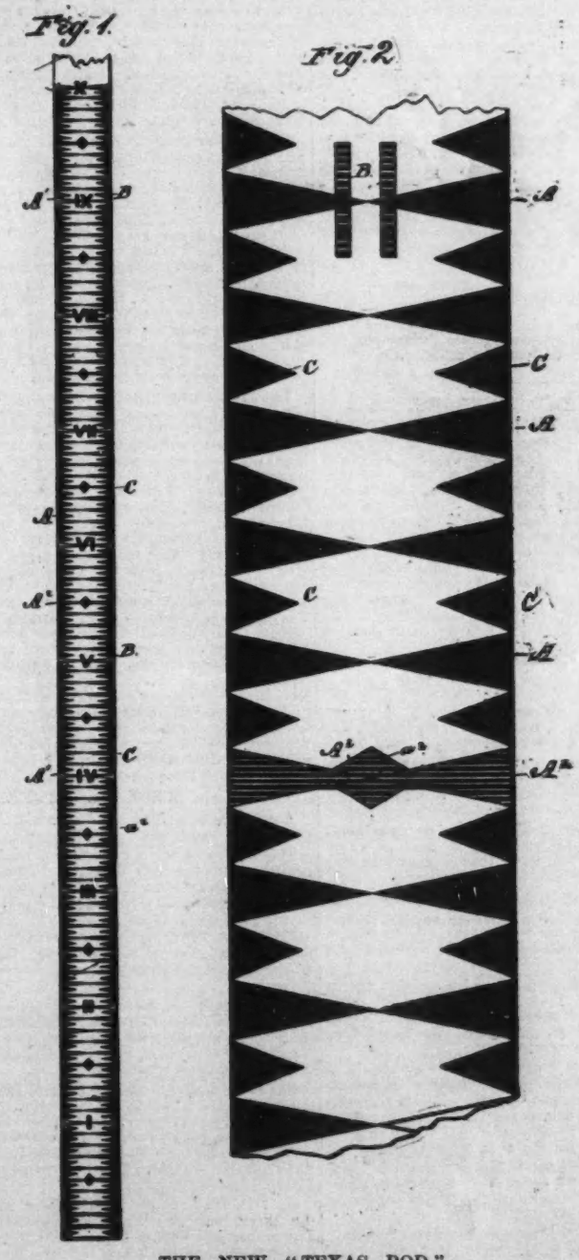
"Recent Break in Case Avenue Main Sewer—Cause, Heavy Land Slide," by B. F. Morse.

No meeting will be held in the month of August.

KANKAKEE, Ill., July 12.—Articles of incorporation of the Indiana, Illinois & Iowa Railroad Company were recorded in this county to-day. This is the new company organized to carry on the work begun ten years ago by the Plymouth, Kankakee & Pacific Company. The amount of the capital stock named is $1,500,000. The line will be built from Plymouth, Ind., to a point on the east bank of the Illinois River, in Mercer County.

THE NEW "TEXAS ROD."

We are in receipt of specifications and a specimen of the new self-reading level rod which has lately been patented by Mr. M. L. Lynch, one of the engineers on the Gulf, Colorado & Santa Fe Railway, of Texas. The rod—as far as can be judged without an actual trial in the field, but from a careful examination of the principle on which it is constructed, and from the testimonials received—seems to be the long looked for desideratum of a perfect self-reader, with extreme accuracy on



THE NEW "TEXAS ROD."

turning points without the use of a target. It is extremely simple and novel in its construction, and like many other inventions, seems to be a "child of necessity." The following extracts from a letter from the inventor explain the rod and its action better than any description we could give:

"To an engineer the principle on which the rod is constructed requires no explanation; it is simply a self-reader, so graded that the position of each tenth (0.10) and each quarter of a tenth (0.025) are defined with *absolute accuracy* (as much so as if a target was used) by means of triangular figures, which have also the advantage of enabling the instrument man to determine smaller subdivisions with greater accuracy. I designed the rod over a year ago, and have had it in constant use ever since on various kinds of work, especially bridging. * * * *

"That a self-reader with the accuracy of a target rod on turning points has been a want as old as the profession, will be admitted by any engineer who has ever done much field work. I have no doubt you have felt the want of it, and I know I have sorely; in fact my needing one about a year ago was how I came to design this one. I had eighteen miles of grading without an assistant, over very rough, broken ground, and found I could not keep up with the target rod. I went to the nearest settlement for a piece of fence plank and made the first of these rods, which is still in use on this road."

The following testimonial will show the value of the rod:

(Copy.)

"I have used one of Lynch's self-readers in checking elevations on a pile and trestle bridge, 4,000 ft. long (which had previously been laid off with a target rod). I found it wonderfully expeditious and convenient, and as accurate as the target rod.

"I consider it the perfection of a level rod, and now use no other kind.

"A. BAUR, Assistant Engineer."

The invention consists in the peculiar form of the marks upon the face of the rod by which it is graduated, whereby the rod may be read with great accuracy to the one-hundredth part of a foot without the use of numerals to indicate the fractional parts.

An inspection of the accompanying drawing will fully explain the rod. Fig. 1 is a front elevation, and Fig. 2 a similar view of a smaller portion of the rod upon a larger scale.

There can be no doubt, even from a cursory examination, but that rapid and accurate leveling can be done by the use of this rod; and if it turns out to be all that is claimed for it—which we have no reason to doubt—it is certain to come into general use with the profession.

A specimen section of the rod can be seen at this office.*

A CANADIAN SURVEYOR'S DIFFICULTIES.

The work, as will be seen by the instructions, is of a decidedly interesting and pleasant character, and is certain to throw a great deal of light on the resources of the Upper Ottawa country. It has drawbacks, however. This region is infested with countless billions of mosquitoes and black flies, the latter such untiring and blood-thirsty persecutors of man and beast that, notwithstanding all attempts to baffle them, they sometimes girdle a man's neck and wrists with bands of raw flesh. They make their way through mosquito nets and even crawl up shirt sleeves to inflict a painful bite when least expected.

The swamps of this western country are mostly cedar, and at this dry season of the year are easily traversed. The way is hewn by axemen for the surveyor's sighting apparatus, and sometimes across a valley the sight may be taken by simply cutting down the upper branches of intervening trees, and occasionally by even chopping a piece out of a trunk.

The most embarrassing obstacle to the progress of a surveying party is a tract swept by a forest fire. This is called a *brule* by the surveyors of the upper country, and is a common feature of the landscape. Vegetation is generally swept entirely away, and the blackened trees fall in every direction in inextricable confusion. Here and there the roots are torn up, and extend their tangle of woody fibers, half filled in with earth, to a height of twelve or fifteen feet. Amid this wild of burnt trees—some of them prostrate and others swinging their giant lengths at elevations of many feet—a thick growth of poplar springs up, tangled round with raspberries and other vines in an exuberance of vegetation rivalling the tropics.

Here the surveyor makes slow progress. Axes may have swung all day long, and but a short distance has been made. The work is one of continued climbing, faultless eye-measurements, but faulty leaps from trunk to trunk. A foot slips off the treacherous blackness of a tree-bridge, or a brittle branch gives way, and a man suddenly disappears in the jungle below, to reappear again with face and hands scratched by the raspberry vines, and marked by broad streaks of charcoal. This is the kind of experience which Mr. Niven and his party will have to undergo in the district between Nipissing and the Ottawa.—*Globe.*

PROGRESS OF THE TELEGRAPH.

(From the Journal of the Telegraph.)

In 1844 there were forty miles of line and no wires.

In 1848 there were 2,000 miles of line and 3,000 miles of wire.

In 1853 there were 14,675 miles of line and 22,013 miles of wire.

In 1860 there were 17,582 miles of line and 26,375 miles of wire.

In 1866 there were 29,412 miles of line and 50,294 miles of wire.

In 1870 there were 58,403 miles of line and 107,245 miles of wire.

In 1877 there were 111,652 miles of line and 257,974 miles of wire.

In 1880 there were 142,364 miles of line and 350,018 miles of wire.

The first line of telegraph in the United States was established between Baltimore and Washington in 1844. This was the Morse plan, which has since become the almost universal system of the world. Fifty million messages were sent during the year 1880. The companies employ 24,000 persons, and have 14,000 offices.

The cost of pumping water into the Hiland Reservoir, Pittsburgh, for the month of June, was 6 mills per 1,000 gallons, which is equal to raising 5,345,666 pounds one foot at a cost of one cent for coal.

* See advertisement on page viii.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

The bill authorizing the Water Commissioners of Ogdensburgh, N. Y., to extend the water-works, has passed the State Legislature.

CHICAGO, July 11.—The Council to-night passed an ordinance empowering the Mayor and Commissioner of Public Works to contract for two more engines for the West Side Water-works, each with a capacity of 15,000,000 gallons daily, and to cost $275,000. An ordinance is proposed to allow the formation of a new company to supply water for mechanical purposes.

Water-works matters in Guelph, Ont., are somewhat muddled. The Commissioners let contracts for excavating and for piping, for a considerable extensions of the mains, on the strength of a $10,000 by-law, to be submitted to the ratepayers. This by-law has been defeated; hence the awkwardness of the situation.

Mr. D. Kennedy, who has been engaged in manufacturing gas and water valves under his patent granted in 1879, for the past four years in this city, is now located at 73 Beekman street and reports business exceedingly good. He is now engaged in constructing a number of 48-inch water valves, on a contract recently awarded him, and is also constructing a full assortment of smaller sizes.

City Engineer Cregier, of Chicago, opened bids for the proposed Bridgeport pumping-engines. Four were received. Charles A. McDonald, of Chicago, offered to construct engines of the required power for $193,000; Mr. M. F. Palmer, of the Quintard Iron Works, for $147,500; George Whittaker, for $149,000; the Centennial Iron Works, for $200,000. Each proposal was accompanied with full specifications of the machinery, and it will take the engineer's department several days to ascertain whether the lowest bidder really offers the most for the least money. The Quintard Iron Company guaranteed for their engines the power and capacity to be equal to the advertised requirements. They offer to furnish the Andrews centrifugal pumps, eight boilers, with a heating surface of 9,200 square feet and a grate surface of 288 square feet. The engines will consist of four sets of centrifugal pumping engines, having an aggregate capacity of 60,000 cubic feet per minute, 8 feet high, making 100 revolutions per minute, under a steam pressure of 80 lbs. They offer to give their engines the usual tests as to power and economy of fuel, and to keep them in repair for a year.

Mr. J. J. R. Croes, the engineer of the reorganized Water-works Company of Indianapolis, has made a report, including recommendation of certain changes in the present system, so that there may be a constant and unlimited supply of pure water for that city. It is proposed to cut off immediately the supply from immediate vicinity of the works, so as to avoid the contaminating influences of the pork houses and other establishments. To do this a thirty-inch pipe will be run three thousand feet north of the works, and from its extremity a filtering gallery will be run 6,000 ft. northeast, from which it is expected to obtain an unlimited supply of pure water. After that is done the pump-works will be moved two or three miles above their present location, and an immense double stand-pipe will be erected in the central part of the city and a large reservoir in the outskirts. Besides these improvements, there will be a general reorganization of the distributing-pipe system, reducing the quantity of small pipe and increasing the large, so as to give a more adequate protection from fire. The estimated cost of all these improvements is $346,000, but the greater part of the work cannot be done until the recommendations have been considered by the directors. The 3,000 ft. of pipe will be laid at once, and the local managers of the company think that the entire work will soon be under way.

TORONTO WATER-WORKS EXTENSION.—The work is going on at present at the old filtering basin. This basin is now lying useless, as it has for the past two years. A channel has been opened into it from the lake, and the dredge is now at work clearing a place for the joining of the new extension to the old pipe, which will be effected by means of a crib. This crib is partially constructed, and will soon be ready to put in place. It is constructed in two shells, the outer of which will contain the sand which is intended to anchor it down and keep it in place, while the inner one is strongly bulk-headed with inch-and-a-half and two-inch planking, and which is to contain an iron tank connected on the south side with a short section of large six-foot pipe, and on the north with another of four-foot pipe. These sections are built into the crib, and will be joined to the extension and short end respectively in the same manner in which the sections of the former are to be coupled, which will be described presently. Beside the water is a 200-foot section of the new pipe, which, with another section of the same dimensions, will reach from the crib already mentioned to the south shore of the island. The intention is to add to these 400 feet of large pipe, 2,000 feet more of a precisely similar character to extend out into the lake, where the end will rest upon the bottom at a depth of 26 feet from the surface. Every hundred feet of this pipe will be anchored down by means of a stone-filled crib, which will be built around it and filled with stone to guard against the possibility of breakage or accidents. This new extension pipe is six feet ten inches in gross diameter, leaving a clear cavity of just six feet. It is built of oak staves five inches thick, and hooped with bands of three-quarter inch wrought-iron three inches wide, two feet apart from center to center. Each of these two hundred feet sections of pipe is furnished at the ends with heavy cast-iron collars, provided with wide, massive flanges which are pierced with bolt holes. When a section of pipe is completed it will be sunk and brought so that the flange at its end will be exactly fitted to the next flange, and then the services of a diver will be brought into requisition to put the bolts in place and screw the nuts on tightly. The heavy oak staves are carefully caulked and tarred, so that when immersed in the water for a few days the pipe will be absolutely water-tight. To prevent leakage at the ends of the staves these are joined with tarred iron tongues fitted carefully into grooves prepared to receive them. The city or shore end of the pipe will be the one formerly used and which is now in place. It has a clear diameter of four feet. In the well in the connecting crib, already described, screens will be fitted to prevent the passage of anything from the lake into the smaller pipe. It is expected that the water will be let in and used in the city as soon as connection with the open lake shall have been completed, and in the meantime the laying of the other sections of the extension will be proceeded with. According to this arrangement water consumers in the city may expect to be supplied with pure lake water in the course of three weeks or less—*Globe*.

BRIDGES.

Gov. Cornell has signed the bill authorizing Plattsburgh to borrow money and issue bonds for the purpose of paying the expense of building a bridge over the Saranac River.

RIVERS AND HARBORS.

The sub-committee of the Senate Commerce Committee to examine into the matter of improving the river front at Washington, met at the Capitol July 14, and decided to arrange for a board of survey, to consist of three army engineers, three civil engineers and a representative from the Board of District Commissioners, for the purpose of making surveys and examinations and to prepare a plan for the removal of the flats and the improvement of the channel and river-front. The committee will not meet again until October, at which time it is expected the Board of Survey will be prepared to submit a report. The committee consulted in the afternoon with the Secretary of War and Gen. Wright, Chief of Engineers, relative to the composition of the proposed board.

RAILROADS.

The new railroad to San Francisco, through Arizona, runs for sixty miles along a basin that is 250 feet below the level of the ocean.

The Chicago & Northwestern has made a permanent survey for a route from Lake City, in Calhoun County, Ia., to Rockwell, and will build the road if the necessary subsidies are granted.

The West Shore Railroad Company has purchased from the National Bank of Newburg a tract of water front in that city 1,700 feet wide, the company paying for the same $110,000.

The Northern Pacific Railroad has found it impossible to grade the north bank of the Yellowstone all through Montana, and has been surveying through the Crow country on the south bank, hoping to get permission to build there.

The Texas & Pacific Railroad has been completed to the eastern boundary of Tom Green County, 500 miles west of Marshall. Its present rate of construction indicates arrival at El Paso del Norte by November, two months ahead of the required time.

The New Orleans *Times* says the railway mania is raging to such an extent, and everybody is so deeply imbued with the railroad projects, that of late the children are born with "two streaks of rust and the right of way" on their backs.

The survey for the Chicago Belt Line Railroad, of which Milton Weston is General Manager, has now been completed, and the final location will be decided upon in a few days. Some of the more important contracts have already been awarded.

The Chicago, Portage & Superior Railway Company have let a contract to Mr. H. G. Angle, of New York, a railroad builder, to construct sixty-five miles of their line southeastwardly from Superior. This will bring the line to a connection with the North Wisconsin Division of the Omaha line.

The Mexican Central has now some sixty miles of road completed, and the Sonora road about the same number of miles. The Topeka & Santa Fe has been completed to El Paso, where the Mexican Central is concentrating the materials for the first fifty miles of the road, to be constructed southward toward the city of Mexico, even the sleepers having to be purchased in Chicago.

The Buffalo, Pittsburgh & Western Railroad Company is building an extension of fifty miles from Brocton to Buffalo, also a branch of equal length from Warren, Pa., up the Allegheny River to Salamanca, Pa. The New York & Pennsylvania Construction Company is doing the work; Walter Scott, of Dunkirk, Chief Engineer, having charge of the Buffalo extension, and Geo. W. Howell, of New Jersey, being over the river division, with headquarters at Warren, Pa.

Christopher Lewis, Superintendent of the Columbus rolling-mill, has invented a machine which, if it does the work the inventor expects, will revolutionize work in rail mills. Mr. Lewis expects that the machine, with three boys to run it, will save the labor of twenty-six men. It consists of seven sets of rolls, through which the iron passes before it comes out, the finished rail or plate with automatic carriage for receiving the metal from one set of rolls turning it over and starting it through another set.

The State government at Harrisburg, Pa., has incorporated the Franklin & Clearfield road, 136 miles long, to be constructed from a point in or near Chambersburg to a point on Clearfield Creek, in the township of Baccaria, in the county of Clearfield, and to run through the counties of Franklin, Huntingdon, Blair, Cambria and Clearfield. Capital stock, $816,000 President, Thomas E. Shoemaker, Philadelphia; directors, Edwin S. McConaughy, Robert M. Janney, B. F. Stratton, John J. Summers, E. J. Price, Walter Clark, Charles D. Barney and William F. Hirons, all of Philadelphia.

The proposed construction of a new railroad on Long Island, to be known as the Northern Railroad of Long Island, has now begun to take material shape. Prominent among the Board of Directors are the Hon. Wm. J. Youngs, A. H. Baldwin, John Duryea, C. L. Vandewater, William F. Redmond and R. M. Jordan. As planned now the road will extend from Astoria to Huntington, a distance of 38 miles, and for this extent of the road nearly all the plans and specifications have been agreed upon. The contract for building the road has been taken by Col. J. C. Lane for $3,000,000—$2,000,000 in the bonds and $1,000,000 in the stock of the company. It is said that work will be begun early in August. Other particulars as to the character and route of the road, except that it will be first-class in every particular, are not yet made public.

The contract for grading, building and equipping the Chicago & Atlantic Railroad was awarded to Messrs. Conant & Smith, New York contractors, last week, and they are now sub-letting contracts for the different kinds of labor to be performed. The work under the contract is to be commenced at once, and it is stipulated that the road shall be ready for the operating of trains by July 1, 1882. The road to be built will extend from Marion, O., through Central Ohio and Northeastern Indiana to Chicago, and it is claimed by the engineers that the maximum grade will not exceed twenty-six feet to the mile. The route is almost a "bee-line" from Marion to Huntington, Ind., and from Huntington the direction as surveyed is northwesterly to Rochester, Crown Point and Chicago. The company has contracted for entrance into Chicago over the tracks of the Chicago & Western Indiana Railroad. The distance by the route of this projected trunk line from Chicago to Marion is 270 miles. Although projected by a company organized expressly for the purpose, this road is intended to be a direct connection; indeed, little else than an extension of the old Atlantic & Great Western, now known as the New York, Pennsylvania & Ohio Railway.

NEW PROJECTS.

American capital is pushing itself into the British Columbian coal fields.

There remains about 260 miles of road to construct to complete the through line from Richmond, Va., to Toledo, Ohio, by way of the recently consolidated Richmond, Allegheny & Ohio Central route.

Work is to be commenced immediately upon the Missisquoi & Black River Railway, the contract having been let at $7,000 per mile, and the sum necessary to secure its completion deposited for the contractors.

Mr. Henry Villard says that $30,000,000 subscriptions have been paid into the new company consolidating the Northern Pacific and Oregon Navigation Company, the limit being $50,000,000. He predicts completion of the road within two years, and will embrace about 6,000 miles of main and tributary railway.

The subscription books of the Palestine Railroad Company have just been opened in Boston. The corporation was formed in February, 1880, under the Massachusetts laws, and has for its purpose the construction of a railroad and telegraph line from Cairo in Egypt through Palestine to Assyria. The par value of the stock is $100.

Hon. R. W. Thompson, of Indiana, late Secretary of the Navy, has been elected President of the Baltimore Cincinnati & Western Central Railway Company, an organization to build a new railroad from Baltimore to Cincinnati over a route by way of the south branch of the Potomac, Elk River, Great Kanawha River and Ohio River.

Mr. William Stanton, of Cohoes, N. Y., who was recently awarded the contract by the government to remove the reef of rocks in the bed of the river opposite Van Wie's, has of late been looking over the obstructions and will soon begin operations. It is calculated that 7,000 feet of rocks and earth will have to be removed and the former will have to be blasted. The contract price is $37,000.

Since Friday last masons have been busy in building the breakwater caisson of the Albany and Greenbush bridge in the crib constructed for that purpose, which was on that day placed in the position in which it is to be sunk. The piles for the pivot pier are nearly all driven, and two pile-drivers are at work sinking piles for the lower rest of the draw. The crib for the pivot caisson is nearing completion, and will be in readiness by the time the piles on which it is to rest are ready.